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An Inventory of State Natural
Resources Information Systems

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An Inventory of State Natural
Resources Information Systems

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Prepared for
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INTRODUCTION

The purpose of this interim report is to summarize the status of a project to inventory state natural resources information systems. This project is being undertaken by the Kansas Applied Remote Sensing (KARS) Program, University of Kansas Space Technology Center, through NASA Grant NAG 2-201. All tasks accomplished during the first seven months of the project (September 1, 1982 - March 31, 1983) are described, and tasks remaining to be completed are outlined.

OBJECTIVES AND SCOPE OF PROJECT

The primary objectives of this project are to locate, identify and document computer-based natural resources information systems (NRIS) and/or data bases maintained by agencies of state government in the U.S. These systems or data bases are being documented only where geographic coverage is statewide or regional in extent.

Documentation of state data bases is limited to those containing natural resources and related data. Such data types broadly include air quality/meteorology, geology, land use/land cover, soils, fauna, vegetation, and water. An attempt is also being made to document data bases which contain socio-economic data, provided the data are collected and managed by a state or sub-state level of government and not by a federal office (e.g., U.S. Bureau of the Census).

All information collected on these data bases will be organized and incorporated in a master computer data base at the University of Kansas Space Technology Center. The master data base will facilitate cost-effective storage, analysis, manipulation, retrieval and dissemination of data collected during the study.

METHODOLOGY

The inventory of state data bases is being conducted for all 50 states, Puerto Rico and the Virgin Islands. The strategy for acquiring information about natural resources or related data bases involves (1) identification of contacts in each state/territory, (2) distribution of a preliminary synoptic questionnaire for data bases identified by state contacts, (3) review and evaluation of all data bases located through this process, (4) distribution

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of a detailed follow-up survey for all relevant data bases, (5) entry of data base descriptions into a master data base, and (6) preparation of a final tabular and textual summary report.

PROGRESS AND ACCOMPLISHMENTS

Project work during the first seven months of this effort has focused on:

1. Project coordination, preparation of a filing system and status worksheets, and exchange of information with other interested parties;
2. Identification of contacts in each state/territory;
3. Distribution of preliminary questionnaires to acquire synoptic information about data bases identified by state contacts;
4. Review and evaluation of preliminary questionnaires returned by state contacts to determine what follow-up efforts are required;
5. Development of a follow-up survey designed to acquire detailed characteristics of all relevant data bases located;
6. Initiating distribution of the follow-up survey to state participants;
7. Testing the software being utilized for creating the KARS Master Data Base of information systems and repositories identified in the states; and
8. Establishment of a comprehensive work plan and timetable for project completion.

Each of these is discussed in more detail below.

1. *Project coordination, preparation of a filing system and status worksheets, and exchange of information with other interested parties.*

The tremendous amount of correspondence anticipated in a project of this type called for devising a means to keep track of communications with all individuals contacted in the states. This was necessary in order to ensure that both initial contacts and new referrals were notified of the study and its objectives, and that any information received was properly acknowledged and followed up. To facilitate project management, a filing system was set up for the 50 states, Puerto Rico and the Virgin Islands. Detailed worksheets were prepared for logging all communications (both

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written and verbal) with individuals in each state/territory, so that the status of any contact could be quickly ascertained, as necessary. These worksheets track the status of preliminary questionnaires, follow-up surveys, and entry of data base characteristics into the KARS Program Master Data base; they also enable recording of all correspondence received or sent (e.g., letters of inquiry, thank you letters, follow-up phone calls).

Project staff also met with Mr. George C. Bluhm, Director of Integrated Resources Information Systems (IRIS), USDA Soil Conservation Service (SCS), Lanham, Maryland; and Sherman J. Rosen, Natural Resource Planning consultant for NASA/Ames Research Center. These individuals discussed SCS needs for accessing existing information regarding soils and related resources. Such information is required by the Soil and Water Resources Conservation Act of 1977 (RCA), calling for the continual appraisal of the status and condition of and trends in soil, water, and related resources in the United States (U.S. Department of Agriculture, 1981). Those discussions concentrated on specific attributes of interest to the Soil Conservation Service, and the mode in which SCS plans to use the results of the inventory (Rosen, 1982).

In addition to the Soil Conservation Service, a broad spectrum of persons and agencies have expressed interest in the inventory of state data bases. These include, for example:

Mr. James Brown, U.S. Fish and Wildlife Service, Office of Endangered Species, Kearneysville, West Virginia

Ms. May Causey, Waterways Experiment Station, U.S. Army Corps of Engineers, Vicksburg, Mississippi

Mr. Charles Cushwa, U.S. Fish and Wildlife Service, Eastern Energy and Land Use Team, Kearneysville, West Virginia

Ms. Shellie Gareau, The Nature Conservancy, Arlington, Virginia

Mr. Julien R. Goulet, Jr., National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Narragansett, Rhode Island

Dr. Roy Mead, U.S. Bureau of Land Management, Technicolor Government Services Inc., Denver, Colorado

Dr. Richard Witmer, U.S. Geological Survey, Reston, Virginia

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Several other individuals from state agencies have also requested information about the inventory, and have been added to the list of contacts for their respective states.

In addition to the communications established with those listed above, KARS staff have presented briefings on the project at appropriate meetings, such as the Kansas Interagency Task Force on Applied Remote Sensing, Topeka, Kansas (November 30, 1982 and March 21, 1983); and the Kansas Groundwater Management Districts Managers' Association meeting, Topeka, Kansas (January 6, 1983). A paper summarizing preliminary results of the inventory has also been proposed for presentation at the Fall Convention of the American Congress of Survey and Mapping/American Society of Photogrammetry (ACSM/ASP), scheduled for September 19-23, 1983, in Salt Lake City, Utah.

An article on the project also appeared in the October 1982 issue of the KARS Newsletter (1982). The Newsletter has a circulation of approximately 2,000. About 75% of the circulation is to Kansans; others are sent throughout the U.S. The project was subsequently noted in the Washington Remote Sensing Letter (1982).

2. *Identification of contacts in each state/territory.*

The initial step in locating state and sub-state data bases involved identification of individuals in each state who would be able to provide information regarding natural resource data bases. At least two, and as many as eight, individuals were identified in each state. Such contacts were identified via personal knowledge of KARS Program staff and/or by referral to lists of conference participants published in the proceedings of recent meetings relevant to the objectives of this project (for example, proceedings of NASA Regional Applications Program conferences, Pecora symposia, and others). Individuals located through conference proceedings frequently were knowledgeable of information systems activities within their state. Publications relating to statewide information systems were also consulted (for example, Cornwell, 1981; Mead, 1981a and 1981b; Tessar and Caron, 1980).

Individuals solicited for information regarding state data bases were largely limited to those representing state agencies or regional levels of government. However, a number of university staff were also contacted in several states, especially when affiliated with a remote sensing center

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(Council of State Governments, 1981). These individuals typically were very attuned to image processing/geographic information systems applications within their respective states, and on many occasions were developing such capabilities on behalf of state agencies.

In addition to those contacts identified through the processes described above, "The National Directory of State Agencies, 1982-1982" was consulted for possible leads (Wright and Allen, 1982). This directory was especially helpful for states where very few contacts were identified through other means.

Each person identified by KARS project staff was asked to refer other state agency personnel responsible for managing automated repositories to the attention of project staff. This facilitated the task of locating data bases, by directing staff to individuals who were recognized by colleagues as being most likely to provide information regarding additional repositories in their state. Also, this approach provided a mechanism to quickly disperse information regarding the data base inventory throughout the states.

The process of contacting new individuals will continue throughout the duration of the project, as long as state participants refer KARS Program staff to other individuals having information on data bases. The number of individuals contacted in each state during the first seven months of this project is summarized in Table 1. The large number of people contacted in some states (e.g., Pennsylvania, Idaho) reflects the active involvement of key agency individuals interested in providing maximum input and support on behalf of their state.

3. *Distribution of preliminary questionnaires to acquire synoptic information about data bases identified by state contacts.*

Preliminary questionnaires were mailed to each contact. This questionnaire (Attachment A) was designed to accomplish several objectives:

- (1) It served to quickly characterize state and sub-state data bases without requiring a great deal of time or effort by the respondent. This was especially important as many of

Table 1. State Contacts

Number of individuals contacted in each state/territory for information regarding state and sub-state data bases, and number of responses received (September 1982 - March 1983). Note that, in many states, key agency personnel coordinated responses on behalf of several contacts. Thus, the number of responses received is actually under-represented.

STATE	# of CONTACTS	# of RESPONSES	STATE	# of CONTACTS	# of RESPONSES
Alabama	13	1	Nebraska	5	2
Alaska	17	1	Nevada	13	2
Arizona	5	2	New Hampshire	8	2
Arkansas	6	2	New Jersey	5	1
California	10	7	New Mexico	6	3
Colorado	5	2	New York	9	3
Connecticut	16	0	North Carolina	15	1
Delaware	7	3	North Dakota	11	5
Florida	6	4	Ohio	5	1
Georgia	7	5	Oklahoma	9	3
Hawaii	12	0	Oregon	14	11
Idaho	10	8	Pennsylvania	46	29
Illinois	10	1	Puerto Rico	10	3
Indiana	5	2	Rhode Island	5	2
Iowa	12	1	South Carolina	4	1
Kansas	19	3	South Dakota	9	3
Kentucky	5	2	Tennessee	14	2
Louisiana	11	4	Texas	3	1
Maine	16	3	Utah	6	2
Maryland	11	4	Vermont	17	8
Massachusetts	12	3	Virginia	6	2
Michigan	5	2	Virgin Islands	5	2
Minnesota	8	3	Washington	8	3
Mississippi	3	3	West Virginia	16	0
Missouri	9	8	Wisconsin	22	18
Montana	20	9	Wyoming	5	2
			TOTAL	536	195

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the responses to this questionnaire were of little or no interest in this project, and were subsequently deleted (e.g., state libraries, NCIC affiliates, annual reports).

- (2) It established whether a data base was automated or manual. (Non-automated data bases were identified because some of these are currently being considered for automation in the near future.)
- (3) It provided a quick overview of the data base (e.g., subject matter included, geographic coverage, date of last update).
- (4) It provided a means to acquire existing documentation of the data base.
- (5) The questionnaire served as a mechanism for notifying the states of the inventory, and obtaining referrals to other individuals in the state who would be able to provide information on additional data bases. In this way, individuals knowledgeable of data base activities in a state were continually being referred to the KARS Program, enabling project staff to contact people having a high probability of being of assistance in the inventory.

4. *Review and evaluation of preliminary questionnaires returned by state contacts to determine what follow-up efforts are required.*

Each preliminary questionnaire returned to the KARS Program was reviewed by project staff and evaluated for possible follow-up efforts. All computer-based natural resources repositories were flagged and will be more fully characterized through follow-up surveys. Non-automated data bases scheduled for automation, or being considered for automation, were identified and their status will be presented in the final report. All non-automated data bases identified through the questionnaire were deleted from further survey efforts, and thank you letters were sent to those respondents. Data bases/repositories not relevant to this study were also deleted (for example, state libraries, bibliographic data bases, NCIC affiliates).

During the first seven months of this project, 263 preliminary questionnaires were reviewed and evaluated (Table 2). One hundred and eighty-five

Table 2. Data Bases Identified Through
Preliminary Questionnaires

Number of preliminary questionnaires received, reviewed, and evaluated for the 50 states, Puerto Rico and the Virgin Islands (September 1982 - March 1983). States followed by an asterisk (*) are those in which a state-wide coordinating system exists, or a catalog of state data bases has been compiled for the state.

STATE	# DATA BASES IDENTI- FIED	RETAINED FOR FOLLOW-UP	STATE	# DATA BASES IDENTI- FIED	RETAINED FOR FOLLOW-UP
Alabama*	1	1	Nebraska*	1	1
Alaska*	1	1	Nevada	3	2
Arizona	3	2	New Hampshire	3	0
Arkansas	4	0	New Jersey*	1	1
California	12	6	New Mexico*	2	2
Colorado*	1	1	New York	7	4
Connecticut	0	0	North Carolina*	1	1
Delaware	3	2	North Dakota	4	3
Florida	3	3	Ohio*	1	1
Georgia	6	0	Oklahoma	0	0
Hawaii	0	0	Oregon	21	20
Idaho	16	14	Pennsylvania	36	28
Illinois*	1	1	Puerto Rico	3	2
Indiana	3	2	Rhode Island	1	1
Iowa*	1	1	South Carolina*	1	1
Kansas	7	4	South Dakota	4	3
Kentucky*	2	1	Tennessee	3	2
Louisiana	4	1	Texas*	1	1
Maine	2	1	Utah	2	1
Maryland*	5	4	Vermont	7	5
Massachusetts	3	2	Virginia*	1	1
Michigan	2	2	Virgin Islands	5	0
Minnesota*	2	2	Washington	15	12
Mississippi*	15	10	West Virginia	0	0
Missouri	10	7	Wisconsin	20	17
Montana	10	7	Wyoming	3	1
			TOTAL	263	185

data bases will be further characterized through a detailed follow-up survey (Table 3). Note that these numbers do not reflect the total number of data bases actually identified, because individuals in several states have agreed to coordinate agency responses on behalf of their state. For example, the Mississippi Automated Resource Information System (MARIS) and the Texas Natural Resources Information System (TNRIS) are charged with the management of numerous data bases on behalf of the state agencies, and staff of those information systems have agreed to handle completion of detailed questionnaires for all state data bases coordinated through the system.

In addition to identifying state and sub-state data bases, the preliminary questionnaire served another, unexpected, purpose. Use of this survey resulted in the discovery of several actual and potential communication problems existing with respect to use of terminology. For example, there was a great deal of misunderstanding as to what constitutes a data base. A number of individuals responded that their agency was a data base. In some cases, the data bases were not identified by meaningful names.

Other misunderstandings pertained to the question, "If automated, does your agency share, or would your agency consider sharing, data with other agencies through an on-line communications link?" Although, invariably, the answer to this question was "yes," those that responded in the negative occasionally inserted an explanation indicating that the reason for not sharing data was related to the lack of appropriate in-house equipment or insufficient funds to support an on-line communications link. Only in one instance did the respondent indicate that the data were confidential. It is not possible at this time to speculate as to why others answered negatively, and therefore, to evaluate their agency's actual willingness to share data.

Another result of the preliminary questionnaire was the surprising lack of documentation received from state agencies to describe their data bases. This lack of descriptive material regarding data bases was disconcerting, as KARS Program staff had hoped to be able to extract much of the information required for this inventory from documentation provided. It will now be necessary to rely heavily on the state agencies for continued cooperation in completing descriptions of their data bases.

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Table 3. Computer-Based State and Sub-State Data Bases

Computer-based natural resources repositories identified through preliminary questionnaires, and retained for follow-up efforts (September 1982 - March 1983). All data bases followed by an asterisk (*) are coordinating centers which manage several discrete data bases, typically on behalf of a number of state agencies.

STATE - DATA BASE NAME	AGENCY	STATE - DATA BASE NAME	AGENCY
<u>Alabama</u>		<u>Idaho (cont'd)</u>	
Alabama Resource Information System (ARIS)*	Alabama Development Office	1975+1980 Land Use Classifications of Ada and Canyon Cities	Department of Water Resources (Remote Sensing)
<u>Alaska</u>		1977 Land Use Classification, Idaho Falls Area	Department of Water Resources (Remote Sensing)
Alaska Land and Resource System (ALARS)*	Department of Natural Resources	Big Game Winter Range Inventory	Department of Water Resources (Remote Sensing)
<u>Arizona</u>		1980 Land Use Classification of the Snake River Plain	Department of Water Resources (Remote Sensing)
Arizona Vegetation Inventory	Arizona State Land Department	Vegetation Classification of Cascade Resource Area	Department of Water Resources (Remote Sensing)
Digital Topo Database	Arizona State Land Department	1980 Irrigation Service - Source Districts	Department of Water Resources (Remote Sensing)
<u>California</u>		Wildlife Habitat Inventory, Fish and Game Unit 54	Department of Water Resources (Remote Sensing)
Land Use	Department of Water Resources	Irrigated Acreage Change Detection in CGW Areas	Department of Water Resources (Remote Sensing)
Land Classification (Suitability for Agriculture)	Department of Water Resources	Upper Snake River, Idaho History File	Department of Water Resources (Hydrology)
Vegetative Water Use Program	Department of Water Resources	Dam Inventory	Department of Water Resources (Dam Safety)
Division of Land Resources Protection-Soils Program	Department of Conservation	Water Rights Data Bank	Department of Water Resources (Water Allocation)
Farmland Mapping and Monitoring Program	Department of Conservation	<u>Illinois</u>	
BASIS (Bay Area Spatial Information System)	Association of Bay Area Governments	Illinois Natural Resource Information Center (INRIC)*	Department of Energy and Natural Resources
<u>Colorado</u>		<u>Indiana</u>	
Colorado Resource Information System*	Department of Natural Resources	Model Implementation Project Data Base	Holcomb Research Institute
<u>Delaware</u>		Planning Region 8 - Eight County Data Base	Holcomb Research Institute
Center for Remote Sensing	University of Delaware-Marine Studies	<u>Iowa</u>	
Delaware Water Use Data System	Department of Natural Resources and Environmental Control	Iowa Water Resources Data System (IWARDS)	Iowa Geological Survey
<u>Florida</u>		<u>Kansas</u>	
Marine Resources Geobased Information System	Department of Natural Resources-Marine Research Laboratory	"Economic Data"	Department of Economic Development
Natural Resources Management Systems and Services Data Center	Department of Natural Resources-Division of Recreation and Parks	Kansas Policy Database System (KPDS)	Center for Public Affairs
Florida Subsurface Geological Data Base	Florida Bureau of Geology	Terrestrial Data Base	Department of Fish and Game
<u>Idaho</u>		Aquatic Data Base	Department of Fish and Game
Land Information and Mapping System	Department of Lands	<u>Kentucky</u>	
Idaho Water Rights	Department of Water Resources	Kentucky Natural Resources Information System (KNRIS)*	Natural Resources and Environmental Protection Cabinet - Mine Data Branch
Idaho Water Use Data System	Department of Water Resources	<u>Louisiana</u>	
		Louisiana Water Well Inventory	Louisiana Geological Survey (Water Resources)
		<u>Maine</u>	
		Maine Lakes Water Quality and Data Base System	Department of Environmental Protection

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STATE - DATA BASE NAME	AGENCY	STATE - DATA BASE NAME	AGENCY
<u>Maryland</u>		<u>Missouri (cont'd)</u>	
Maryland Automated Geographic Information System (MAGIS)*	Department of State Planning	Natural Areas	Department of Conservation
Maryland Geographic Districting Information System	Department of State Planning	Climatological Data (Missouri and other states)	University of Missouri
Maryland Recreation Inventory System	Department of State Planning	Federal-State Cooperative Programs for Population Estimates and Projections	Office of Administration
Maryland Natural Heritage Program	Division of Natural Resources		
<u>Massachusetts</u>		<u>Montana</u>	
ACIO (Water Data)	Division of Fisheries and Wildlife	Montana Trust Lands Inventory	Department of State Lands
Wildlife Species Files	Division of Fisheries and Wildlife	Montana Water Quality Records System	Department of Health (Water Quality Bureau)
		Reservoir Contents	Department of Natural Resources and Conservation
<u>Michigan</u>		Stream Flows	Department of Natural Resources and Conservation
Local Unit Computer Information (LUCI)	Department of Commerce	General Reconnaissance Irrigation Suitability Land Classification	Department of Natural Resources and Conservation
Michigan Resource Information System	Department of Natural Resources - Land Resource Program	Irrigated Lands of Montana	Department of Natural Resources and Conservation
		Montana Dam	Department of Natural Resources and Conservation
<u>Minnesota</u>			
Minnesota Land Management Information Center (MLMIC)*	State Planning Agency	<u>Nebraska</u>	
Regional Energy Information System	State Energy Agency	Nebraska Natural Resources Information System*	Natural Resources Commission
<u>Mississippi</u>		<u>Nevada</u>	
Mississippi Automated Resource Information System (MARIS)*	Mississippi Research and Development Center	Ground Water	Department of Data Processing
NATURAL HERITAGE	Mississippi Remote Sensing Center (Mississippi State University)	Surface Water	Department of Data Processing
PUERTO RICO	Mississippi Remote Sensing Center (Mississippi State University)		
LC50ILE & LC50ILW	Mississippi Remote Sensing Center (Mississippi State University)	<u>New Jersey</u>	
LOWNDES	Mississippi Remote Sensing Center (Mississippi State University)	Department of Environmental Protection Geographic Data Base*	Department of Environmental Protection
CHOCTAW GMA	Mississippi Remote Sensing Center (Mississippi State University)		
LEAF RIVER GMA	Mississippi Remote Sensing Center (Mississippi State University)	<u>New Mexico</u>	
TALLAHALLA GMA (CREATURE)	Mississippi Remote Sensing Center (Mississippi State University)	New Mexico Natural Resources Information System*	Natural Resources Department
BIGBEE	Mississippi Remote Sensing Center (Mississippi State University)	Water Use Data	State Engineer Office
NOXUBEE	Mississippi Remote Sensing Center (Mississippi State University)		
<u>Missouri</u>		<u>New York</u>	
Procedures: A Wildlife Information System for Missouri	Geographic Resources Center (University of Missouri)	Resource Information Laboratory (LUNR)	Cornell University
Nature Conservancy	Department of Conservation	Urban Wildlife Habitat Inventory	Department of Environmental Conservation
Caves of Missouri	Department of Conservation	Significant Habitats Inventory	Department of Environmental Conservation
Rare and Endangered Species	Department of Conservation	Wetlands Inventory (Freshwater)	Department of Environmental Conservation
		<u>North Carolina</u>	
		North Carolina Land Resource Information System*	Division of Land Resources
		<u>North Dakota</u>	
		Annual Use Reports on Water Permits	State Water Commission
		Abandoned Mine Lands	Public Service Commission
		Historical/Archaeological/Paleontological Site Data	Public Service Commission
		<u>Ohio</u>	
		Ohio Capability Analysis Program (OCAP)*	Division of Soil and Water Conservation

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STATE - DATA BASE NAME	AGENCY	STATE - DATA BASE NAME	AGENCY
<u>Oregon</u>		<u>Pennsylvania (cont'd)</u>	
Elk Habitat Inventory and Mapping	Department of Fish and Wildlife	Picture-Rocks-Jonestown Trace Elements	Department of Environmental Resources - Pennsylvania Topographic and Geological Survey
Fish Inventory of Oregon Lakes and Streams	Department of Fish and Wildlife	Pennsylvania Mineral List	Department of Environmental Resources - Bureau of Topographic and Geological Survey
Lake, Reservoir or Pond Fish Distribution	Department of Fish and Wildlife, Fish Division	Directory of Mineral Industry	Department of Environmental Resources - Bureau of Topographic and Geological Survey
Lake, Reservoir or Pond Fish Harvest and Recreation	Department of Fish and Wildlife, Fish Division	Reading Prong	Department of Environmental Resources - Bureau of Topographic and Geological Survey
Natural Lake, Reservoir or Pond Habitat Inventory	Department of Fish and Wildlife, Fish Division	Water Resources Data System	Department of Environmental Resources - State Water Planning Division
Salmon Statistics	Department of Fish and Wildlife, Fish Division	Water Well Inventory	Department of Environmental Resources - Bureau of Topographic and Geological Survey
Stream Fish Distribution and Abundance	Department of Fish and Wildlife, Fish Division	Insect and Disease Storage and Retrieval	Bureau of Forestry - Division of Pest Management
Stream Fish Harvest and Recreation	Department of Fish and Wildlife, Fish Division	Timber Volume Inventory	Bureau of Forestry
OSCAR Forest Inventory	Department of Forestry, Forestry Management Division	Pennsylvania Fish and Wildlife Data Base	Game Commission
Fire Studies	Department of Forestry, Forest Protection Division	Pennsylvania Stream Inventory	Fish Commission
Forest Operator-Landowner Liability Law Administration File (FOLLAD Report)	Department of Forestry, Forest Protection Division	Land Area Inventory	Bureau of Forestry
Insect Damage Survey	Department of Forestry, Insect and Disease Management Section	Pennsylvania Natural Diversity Inventory	Bureau of Forestry
Annual Harvest Report for Oregon	Department of Forestry, Resource Studies Division	Air Quality Permit Applications System	Department of Environmental Resources - Bureau of Air Quality Control
Forest Resources Survey	Department of Forestry, Resource Studies Division	Pennsylvania Emission Data System	Department of Environmental Resources - Bureau of Air Quality Control
Minerals Registry	State Land Division	WAHIS - Water Supplies	Department of Environmental Resources - Bureau of Environmental Control
Ground Water Sources and Aquifer Data, observation well net	Water Resources Department	Pennsylvania Recreation Inventory	Department of Environmental Resources - Bureau of Environmental Planning
Water Quality (WATSTORE & STORET)	Water Resources Department	Nursery Inventory	Department of Environmental Resources - Bureau of Forestry
Streamflow Records	Water Resources Department	Forest Fire Statistics	Department of Environmental Resources - Bureau of Forestry
Water Rights	Water Resources Department	Minerals Storage and Retrieval	Department of Environmental Resources - Bureau of Forestry
<u>Pennsylvania</u>		Timber Sales Computation	Department of Environmental Resources - Bureau of Forestry
Permit Files	Department of Environmental Resources - Bureau of Mining and Reclamation	Mine Subsidence Insurance	Department of Environmental Resources - Bureau of Mining and Reclamation
STORET	Department of Environmental Resources - Bureau of Water Quality Management	Solid Waste Activity Monitoring (SWAM) Facility System	Department of Environmental Resources - Bureau of Solid Waste Management
Pennsylvania Abandoned Mine Lands Inventory	Department of Environmental Resources - Bureau of Abandoned Mines Reclamation	State Park Basic Information Data System	Department of Environmental Resources - Bureau of State Parks
National Coal Resources Data System (NCROS)	Department of Environmental Resources - Pennsylvania Topographic and Geological Survey	Demography	Pennsylvania State Data Center

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STATE - DATA BASE NAME	AGENCY	STATE - DATA BASE NAME	AGENCY
<u>Puerto Rico</u>		<u>Washington (cont'd)</u>	
Land Use	Department of Natural Resources - Scientific Inventory Section	NRIS Water Right Claims, Permits, Certificates and Changes	Department of Ecology
Hydrological Data Bank of Puerto Rico	Department of Natural Resources - Water Division	Water Quality Classifications Monitoring Stations, and Non-Changing Data	Department of Ecology
<u>Rhode Island</u>		Non-game Program Data Storage and Retrieval System Habitat Files	Department of Game
Landsat Remote Sensing Center GIS	Landsat Remote Sensing Center - URI/GSO	AIMS (Surface Mining Permits)	Department of Natural Resources
<u>South Carolina</u>		Forest Productivity	Department of Natural Resources
South Carolina Natural Resource Information System*	University of South Carolina	GRIDS - Gridded Resource Inventory Data System	Department of Natural Resources
<u>South Dakota</u>		LCD Element Occurrence (Nature Conservancy)	Department of Natural Resources
Division of Water Development Climatological Data	Department of Water and Natural Resources	<u>Wisconsin</u>	
File 27 (WNR-LEVELS) (Water well level readings)	South Dakota Geological Survey	Flood Data Repository	Department of Natural Resources - Water Regulation and Zoning
File 28 (Litho., logs, water quality, geo. analyses)	South Dakota Geological Survey	Benchmark Inventory	Department of Natural Resources - Water Regulation and Zoning
<u>Tennessee</u>		Forest Fire Report	Department of Natural Resources - Bureau of Forestry
Tennessee Natural Heritage Database	Department of Conservation	Farmland Preservation Planning and Mapping	Department of Agriculture
Geographic Information System for Tennessee (GIST)	Middle Tennessee State University	Towns, Population Data	Department of Administration - Demographic Services
<u>Texas</u>		Current Mineral Producers	Wisconsin Geological Survey
Texas Natural Resources Information System*	Texas Natural Resources Information System Central	Well Logs System	Wisconsin Geological Survey
<u>Utah</u>		Public Lands	Department of Natural Resources
UGMS CRIB File	Utah Geological and Mineral Survey	Wetlands	Department of Natural Resources
<u>Vermont</u>		Shoreline Inventory	Department of Natural Resources
Water Quality Data System	Department of Water Resources and Environmental Engineering	Southeast Regional Planning Commission File	Southeast Regional Planning Commission
Groundwater Management Section's Data Base	Agency of Environmental Conservation	Data Repository of Nongame, Endangered, Threatened Vegetation and Animals	Department of Natural Resources - Bureau of Endangered Resources
Center for Rural Studies - Vermont State Data Center	Center for Rural Studies - University of Vermont	Scientific Areas	Department of Natural Resources - Bureau of Endangered Resources
Vermont State Data Center	Agency of Development and Community Affairs	General Waters	Department of Natural Resources - Fisheries
WATER (Public Water System)	Department of Health	Forest Tax Law Reminder System	Department of Natural Resources - Bureau of Forestry
<u>Virginia</u>		WTL (Woodland Tax Law Reminder)	Department of Natural Resources - Bureau of Forestry
Commonwealth Data Base (CDB)*	Department of Taxation	Public Lands Forest Reconnaissance	Department of Natural Resources - Bureau of Forestry
<u>Washington</u>		<u>Wyoming</u>	
Shoreline Management Substantial Development Permits	Department of Ecology	Wildlife Observation System	Game and Fish Department
Shoreline Management Conditional Use and Variance Permits	Department of Ecology		
ATLAS CZGIS (Coastal Zone Geographic Information System)	Department of Ecology		
Baselines Intertidal/Subtidal	Department of Ecology		
Air Quality Data Handling System	Department of Ecology		

The preliminary questionnaire also revealed the extent of the problem involved with separating state and sub-state data bases from federal, local, or private data bases. Many questionnaires were returned with descriptions of cooperative efforts that could not always be easily pigeon-holed as a state, federal, or "other" data base.

For example, the State Natural Heritage Programs are undertaken as a cooperative effort between The Nature Conservancy, a national nonprofit conservation organization, and state governments. There are heritage programs in 27 states, the Tennessee Valley Authority Region and New England. A typical natural heritage program is established under a contractual agreement between the state and The Nature Conservancy. Although initial funding is often provided by private sources (usually matched by U.S. Department of the Interior's Land and Water Conservation Fund), more than half of the programs created have been fully incorporated into state government.

Other examples include cooperative efforts between state and federal governments, such as collection of water data (U.S. Geological Survey/state water offices) and collection of information on mineral resources locations (U.S. Geological Survey/state geological surveys). Where cooperative efforts of this nature are identified, summaries of all state offices participating in the effort will be included in the final report.

These and other discoveries pertaining to the diverse ways in which individuals from various state agencies responded to the preliminary questionnaire greatly influenced the design of the detailed follow-up survey.

5. *Development of a follow-up survey designed to acquire detailed characteristics of all relevant data bases located.*

According to the scope of this project, specific data elements to be collected for each data base identified include:

- (1) Data base/information system name and agency identification
- (2) Contacts (e.g., names, addresses, telephone numbers)
- (3) Data type(s) included
- (4) Data format (e.g., classification scheme, resolution or scale, geographic reference, grid/polygon system)

- (5) Geographic coverage
- (6) Accuracy/reliability, if known
- (7) Updating frequency/currency
- (8) Data sources
- (9) Availability of data base to non-agency users
- (10) Security restrictions, if any
- (11) Hardware/software support
- (12) Available documentation of the system or data base
- (13) Implementation problems, if any

The design of the detailed survey developed to collect the information listed above was driven by two basic considerations:

- It was critical that the survey be flexible enough to accommodate diverse data bases of varying sizes. For example, the survey needed to address the characteristics of small data bases developed to handle single themes of data, as well as statewide information systems created to handle large volumes of data on behalf of several state agencies.
- The survey needed to be as brief as possible and easy to complete.

Accordingly, the design of the follow-up survey takes into consideration the tremendous variety of data bases/repositories and other information systems existing in the states, and reduces these into their basic components--i.e., the data--which can then be addressed through a single questionnaire. This approach serves to provide a common ground for all data bases, regardless of their size or the variety of data they contain.

Once the decision was made to survey data types stored in data bases (rather than data bases, *per se*), it was necessary only to consider (1) the computer facilities available to the state agency for automating the data, regardless of how many or how few data categories were involved, and (2) the data categories, themselves. Thus, a survey was designed that allowed maximum flexibility with respect to each agency's approach to organizing its data (Attachment B). The format and substance of specific questions in the survey were derived by reviewing numerous questionnaires utilized

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by various state and federal agencies for assessing data needs or inventorying existing data (Armentano and Loucks, 1979; Brooks, 1980; Gordon, 1981; Hill-Rowley, 1981; Lettman, 1981; Naim, *et al.*, 1980; NASIS, 1982; Potter, *et al.*, 1972; Salmen, *et al.*, 1977; U.S. Geological Survey, 1979; and others).

Part I of the follow-up survey addresses computer facilities available to the state agency, i.e., how and where the data are automated. The computer facilities are characterized on the basis of institutional considerations, hardware, software and peripheral devices available. Agencies need only complete one form to describe their available computer facilities, regardless of the number of repositories under their management.

Some of the questions in Part I are repeated from the preliminary questionnaire for two reasons:

- (1) In the preliminary questionnaire, there was some confusion regarding question #7 pertaining to the site of computer facilities. It was revised and included on the follow-up survey to accommodate agencies utilizing computer facilities at more than one site; additional selections were also provided.
- (2) In several cases, individuals completing the follow-up survey will not have completed the preliminary questionnaire. For example, some respondents simply sent documentation (sometimes for several data bases), without completing preliminary questionnaires for those data bases. Some contacts were interviewed over the phone. It is also likely that some new contacts will complete the detailed survey directly.

Part II of the follow-up survey is variable in length, depending on the variety of data computerized by the responding agency--i.e., one Part II form must be completed for each major data category that the agency manages in an automated fashion. To assist the agency participants in completing the form, a "shopping list" of possible data categories and sub-categories (i.e., data types) is included (see Table 4). This list of data categories was adapted from a summary of SCS information needs reported in a document prepared for NASA/Ames Research Center, "Identi-

Table 4. Data Categories

Data categories and types included in Part II of the follow-up survey: Descriptions of Data Categories. Note that blank spaces are provided so that respondents can create their own data categories and data types, if desired, to better represent the contents and structure of their repository.

- CLIMATE/WEATHER
 - ☐ Rainfall
 - ☐ Wind
 - ☐ Exposure
 - ☐ Evapotranspiration
 - ☐ Temperature
 - ☐ Snowfall/snow depth
 - ☐ Solar radiation
 - ☐ Natural disasters
- DEMOGRAPHY
 - ☐ Populations
 - ☐ Social aspects
 - ☐ Economic aspects
- ENERGY
 - ☐ Resources - coal/lignite
 - ☐ Resources - natural gas
 - ☐ Resources - oil
 - ☐ Resources - hydro-electric
 - ☐ Ownership
 - ☐ Production
 - ☐ Conversion
 - ☐ Transmission
- ENVIRONMENTAL QUALITY
 - ☐ Air quality
 - ☐ Water quality
 - ☐ Point pollution
 - ☐ Non-point pollution
 - ☐ Hazardous wastes
- GEOLOGY
 - ☐ Physiography
 - ☐ Surficial geology
 - ☐ Bedrock geology
 - ☐ Exploration/extraction
- HYDROLOGY - GROUNDWATER
 - ☐ Quantity
 - ☐ Quality
 - ☐ Recharge
 - ☐ Discharge/pumpage
 - ☐ Well location
 - ☐ Water rights
- HYDROLOGY - SURFACE
 - ☐ Discharge/volume/stage
 - ☐ Quality
 - ☐ Water body type
 - ☐ Supply and storage
 - ☐ Watershed boundaries
 - ☐ Flooding
 - ☐ Floodplains
 - ☐ Flood prone areas
 - ☐ Stream orders
 - ☐ Water rights
- LAND COVER
 - ☐ Barren land
 - ☐ Forest land
 - ☐ Perennial ice & snow
 - ☐ Rangeland
 - ☐ Water
 - ☐ Wetlands
 - ☐ Estuaries
 - ☐ Cropland
 - ☐ Pasture
 - ☐ Urban/built-up
- LAND USE (RESOURCES)
 - ☐ Timber
 - ☐ Mineral extraction/energy production
 - ☐ Water use
 - ☐ Cropland
 - ☐ Livestock production
 - ☐ Transportation
 - ☐ Urban/built-up
 - ☐ Recreation
 - ☐ Parks
 - ☐ Unique areas
 - ☐ Cultural areas
 - Historical
 - Archaeological
 - Paleontological
 - ☐ Ownership
- BOUNDARIES
 - ☐ State
 - ☐ Counties
 - ☐ Townships
 - ☐ Census blocks
 - ☐ Watersheds
 - ☐ River basins
 - ☐ Regional planning districts
- SOILS DATA
 - ☐ Type
 - ☐ Series
 - ☐ Association
 - ☐ Engineering characteristics
 - ☐ Capability class
 - ☐ Productivity
 - ☐ Erosion
 - ☐ Conservation measures
- TOPOGRAPHY
 - ☐ Elevation
 - ☐ Slope
 - ☐ Aspect
 - ☐ Relief
- VEGETATION
 - ☐ Species
 - ☐ Communities
 - ☐ Quality/condition
 - ☐ Biomass/volume
 - ☐ Succession
 - ☐ Age
 - ☐ Rare and endangered
- WILDLIFE
 - ☐ Game - mammals
 - ☐ Game - birds
 - ☐ Game - fish
 - ☐ Game - other
 - ☐ Non-game - mammals
 - ☐ Non-game - birds
 - ☐ Non-game - fish
 - ☐ Non-game - marine/estuarial
 - ☐ Non-game - reptiles/amphibians
 - ☐ Non-game - other
 - ☐ Quantity (populations)
 - ☐ Management
 - ☐ Habitat
 - ☐ Threatened and endangered
- OTHER CATEGORY (Please specify)

OTHER DATA TYPES (itemize for category circled above):	<div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px;"></div>
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THESE DATA ARE CONTAINED WITHIN (NAME OF DATA BASE/REPOSITORY): _____

fication of State/Regional Agency Natural Resource Data Bases for Use by the Soil Conservation Service" (Rosen, 1982). The list is not intended to be comprehensive; if it does not contain categories or data types that adequately and appropriately describe the data in a particular repository, respondents are encouraged to provide their own representation of that data in the spaces provided for that purpose.

Questions in Part II of the survey seek to characterize each data category independently of other data categories. This is an important consideration and emphasizes the need for basing the survey on data categories/types rather than data bases. For example, if a state agency describes an assemblage of diverse types of data as a single data base, it is not possible to summarize various aspects of that data base in a meaningful fashion. There is too much variability in characteristics (e.g., geographic coverage, resolution, data sources, reliability and updating frequency) to be able to generalize these features for all data categories within the data base.

The draft follow-up survey was sent to individuals in three states for review by agency personnel in a position to evaluate the instrument for accommodating their particular data base(s). Reviewers included Paul Edward Downing, Manager of the Mississippi Geographic Information Systems Division, which coordinates data for several agencies in the State of Mississippi; Paul A. Tessar, Director of the Computer Resources Division of the Arizona State Land Department, which is building an in-house capability to handle a variety of data needs for the Land Department; and LeRoy Klapprodt, Water Resource Planner for the North Dakota State Water Commission, which is utilizing the state's central data processing facilities to implement automation of a single theme of data relating to water permits. The survey was also reviewed by Dr. T. H. Lee Williams, Associate Professor in the Department of Geography and Meteorology at the University of Kansas. Dr. Williams teaches a series of remote sensing and geographic information systems courses at the University, and provided useful input from the perspective of a remote sensing/image processing specialist. Though these individuals represent a diverse range of viewpoints, and deal with data bases of varying sizes and structures, all reviewers agreed

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that the survey was flexible enough to complete without difficulty. They also offered several suggestions for improving a number of the questions included in the survey.

6. *Initiating distribution of the follow-up survey to state participants.*

Prior to mailing out the follow-up survey to the states, project staff are extracting information from the preliminary questionnaires and documentation sent to the KARS Program for each data base. This information is being inserted onto the follow-up surveys for each data base, in an effort to assist state contacts in completing the forms. By initiating completion of the forms, project staff hope to:

- Decrease the need for agency staff to refer to the instructions attached to the survey, thereby reducing the time required to complete the form;
- Increase the response rate by showing "good faith" efforts on the part of project staff; and
- Reduce the possibility of receiving "bad" data, by directing the approach for dealing with the data categories (Part II) in each data base, on a case-by-case basis. The data categories will be identified based on information supplied by the respondent in the preliminary questionnaire, Question #2, Subject Matter Included.

7. *Testing the software being utilized for creating the KARS Master Data Base of information systems and repositories identified in the states.*

All information collected on state and sub-state data bases will be incorporated into a master computer data base at the University of Kansas Space Technology Center. This data base will facilitate cost-effective storage, analysis, manipulation, retrieval and dissemination of data collected during the study.

Work is underway on the design of files, CRT screen forms and report formats to be used with the data base management system RTFILE, a commercial product acquired by the KARS Program. RTFILE will be used for interactive data entry, verification and editing, query and retrieval operations and the generation of formatted output. A new, updated version of RTFILE that will be used for production purposes is also on order.

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8. *Establishment of a comprehensive work plan and timetable for project completion.*

KARS staff have established the following schedule for project execution. This timetable prioritizes project tasks and sets goals for their completion.

April-May 1983

- Extract information from documentation received for state data bases, and insert it onto follow-up surveys; mail to state participants for completion
- Continue contacting new referrals regarding possible additional data bases
- Continue review and evaluation of preliminary questionnaires received; follow up each as necessary
- Preparation of follow-up surveys for entry into the KARS Master Data Base
- Complete evaluation and testing of RTFILE software for storing, analyzing, and retrieving data base summaries
- Initiate data entry into KARS Master Data Base

May-June 1983

- Continue distribution of follow-up surveys, as required
- Continue contacting new referrals
- Continue review, evaluation and follow-up of preliminary questionnaires
- Continue data entry into KARS Master Data File
- Initiate data editing

June-July 1983

- Continue distribution of follow-up surveys, as required
- Continue data entry and editing of the KARS Master Data File
- Pursue active follow-ups for any detailed surveys not returned to the KARS Program

August-September 1983

- Continue distribution of follow-up surveys, as required
- Continue data entry and editing of the KARS Master Data Base

August-September 1983, cont'd

- Initiate analysis of state and sub-state data bases
- Initiate preparation of a summary report for distribution to all state agencies and others participating in the project
- Present preliminary results of the study at the Fall Convention of the ACSM/ASP meeting in Salt Lake City, Utah

October 1983

- Complete analysis of state and sub-state data bases and prepare summary statistics for final report
- Complete final report
- Complete summary report for distribution to participating state agencies and others, and consult with NASA on the substance of the report and the timing of its release.

Throughout the coming months KARS staff will maintain liaison with NASA/Ames Research Center. KARS staff will take every opportunity to present information on the project at meetings and conferences. KARS staff will also analyze the need for inventories of data bases not addressed by this study.

TASKS YET TO BE ACCOMPLISHED

There are five major tasks remaining to be accomplished in the inventory of state and sub-state data bases. These are:

- (1) Referrals - Individuals will continue to be contacted throughout the remainder of the study, so long as new referrals are brought to the attention of project staff.
- (2) Follow-up Survey - Surveys requesting detailed information regarding state and sub-state data bases will continue to be sent to state agency participants so long as new data bases are identified. Although it is not possible to know how many natural resources data bases exist in the states, we believe that most of them (75%) have been identified in our study, to date. This estimate is based on the recent decline in new referrals and the reduced number of preliminary questionnaires being returned in response to our search.

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- (3) Master Data Base - All data derived through the detailed follow-up survey must be entered into the KARS Master Data Base, followed by editing, analysis, indexing, and retrieval of the data.
- (4) Final Report Preparation - The final report will include a description of the methodology utilized for completing the inventory of state and sub-state data bases; a summary of all data bases identified and characterized through this study; and a discussion of the need for additional inventories of data bases not addressed in this study. The data bases will be cross-indexed by state, data base name, acronyms, data categories, and others, as appropriate.
- (5) Summary Report - A brief summary of data bases identified through this study will be prepared and sent to all agencies and others that participated in the study.

PROBLEMS

No significant problems have been encountered other than those noted elsewhere in this report. These include the notable lack of documentation received from the states for existing data bases, and the difficulty of determining the status of various cooperative data base efforts (e.g., state/federal or state/private) for purposes of this study.

SUMMATION

Work to date on the inventory of state and sub-state data bases has resulted in the following accomplishments:

- A filing system was implemented to store documentation received for data bases, and worksheets were developed to track all correspondence with state contacts. In this way information can be quickly retrieved as necessary, especially for data entry into the KARS Master Data Base, and the status of each contact can be easily ascertained.
- Five hundred and thirty-six state contacts have been identified and are being asked to provide information regarding existing data bases within their state (see Table 1).

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- A preliminary questionnaire was developed to facilitate initial identification of data bases (see Attachment A).
- Two hundred and sixty-three preliminary questionnaires were reviewed and evaluated for possible follow-up action (see Table 2).
- A follow-up survey was developed for use in acquiring detailed information regarding data bases (see Attachment B), and was reviewed by state agency personnel in three states.
- The task of sending out follow-up surveys has been initiated. This effort involves filling out the survey form for each participating agency to the extent possible by KARS Program staff prior to sending the forms out for completion. This, we anticipate, will provoke a greater response rate from state agencies.
- The software being utilized for data entry is being fully tested and evaluated to ensure that data are entered in a way that will enable analysis and retrieval of the data for searching and reporting purposes.
- A timetable for project completion has been prepared.

No significant problems have been encountered or are foreseen.

REFERENCES

- Armentano, T. V. and O. L. Loucks. 1979. "Ecological and Environmental Data as Under-Utilized National Resources: Results of the TIE/ACCESS Program," The Institute of Ecology (TIE), Indianapolis, IN. 98 pp., appendices.
- Brooks, K. M. 1980. "Requirements for a Statewide Geographic System: A Survey of Agency Data and Analytical Needs," Geography Department, Oregon State University, prepared for the Oregon State Department of Forestry. 70 pp., appendices.
- Cornwell, S. B. 1981. "History and Status of State Natural Resources Systems," paper presented at the Urban and Regional Information Systems Association Conference, August 1981, New Orleans, L.
- Council of State Governments. 1981. "State Remote Sensing Programs Catalog," prepared for the Earth Resources Data Project, Council of State Planning Agencies, Washington, D.C. 66 pp.
- Gordon, K. E. 1981. "Environmental Data Use in Computer-Assisted Data Handling Systems: The Results of a Survey of Applications in the Pacific Northwest States," Occasional Paper #15, Center for Pacific Northwest Studies, Western Washington University. 162 pp.
- Hill-Rowley, R. 1981. "The Michigan Data Needs Questionnaire," presented at the Eastern Regional Remote Sensing Applications Center Conference, March 11, 1982, Boston, MA.
- "KARS Program to Inventory State Data Bases," in KARS Newsletter, 11(4): 1, October 1982. University of Kansas Applied Remote Sensing Program, Lawrence, Kansas.
- Lettman, G. 1981. "Developing a GIS Data Base System to Meet State Agency Data and Analytical Needs," Oregon State Forestry Department, Forestry Assistance Division. 36 pp.
- Mead, D. A. 1981. "Statewide Natural-Resource Information Systems - A Status Report," Journal of Forestry, 79 (6): 369-372.
- Mead, D. A. 1981. "Data Quality in State-Level Natural Resource Information Systems," Dissertation, University of Missouri - Columbia. 108 pp.
- Naim, S., R. Slade and K. M. Brooks, 1980. "An Inventory of Federal and State Agency Data Collections for the State of Oregon," Geography Department, Oregon State University, prepared for the Oregon State Forestry Department.
- National Association for State Information Systems. 1982. "Information Systems Technology in State Government," developed by NASIS in conjunction with the states, Lexington, KY. 39 pp., appendices.

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- Potter, D. R., K. M. Sharpe, J. C. Hendee, and R. N. Clark. 1972. "Questionnaires for Research: An Annotated Bibliography on Design, Construction, and Use," Pacific Northwest Forest and Range Experiment Station, USDA Forest Service Research Paper PNW-140, Portland, OR. 80 pp.
- Rosen, S. J. 1982. "Identification of State/Regional Agency Natural Resource Data Bases for Use by the Soil Conservation Service," prepared for the National Aeronautics and Space Administration/Ames Research Center, Moffett Field, CA.
- Rosen, S. J. 1981. "Automated Federal Natural Resource and Related Data Systems," prepared for the Soil Conservation Service Integrated Resources Information Systems, Washington, D.C. 77 pp., appendices.
- Salmen, L., G. Gropper, J. Hamill, G. Nez, and C. Reed, 1977. "User Needs Assessment Forms for an Operational Geographic Information System Within the U.S. Fish and Wildlife Service, Region Six," Report 1.3, Western Energy and Land Use Team, Office of Biological Services, U.S. Fish and Wildlife Service. FWS/OBS-77/002.
- Tessar, P. A. and L. M. Caron. 1980. "A Legislator's Guide to Natural Resource Information Systems," National Conference of State Legislatures, Denver, CO. 59 pp.
- United States Department of Agriculture. 1981. "Soil, Water, and Related Resources in the United States: Status, Condition, and Trends," 1980 Appraisal, Part I. 328 pp.
- U.S. Geological Survey. 1979. "Scientific and Technical, Spatial, and Bibliographic Data Bases of the U.S. Geological Survey, 1979," compiled by the Office of the Data Base Administrator, Geological Survey Circular 817.
- Washington Remote Sensing Letter, 2(9): 2, November 11, 1982. Murray Felsher, Publisher, Washington, D.C.
- Wright, N. D. and G. P. Allen, Compilers. 1982. "The National Directory of State Agencies, 1982-1983," Information Resources Press, Arlington, VA. 793 pp.